RECLAMATION

Managing Water in the West

APPRAISAL REPORT

Prepared under the Bureau of Reclamation's Rural Water Supply Program

Sulphur Pipeline Regional Rural Water Supply Project

Great Plains Region, Oklahoma-Texas Area Office

U.S. Department of the Interior
Bureau of Reclamation

October 2013

Mission Statements

The mission of the Department of the Interior is to protect and provide access to our Nation's natural and cultural heritage and honor our trust responsibilities to Indian Tribes and our commitments to island communities.

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

TABLE OF CONTENTS

TABLES

FIGURES

ACRONYMS

CMP	Comprehensive
CWSRF	Clean Water State Revolving Fund
D&S	Directives and Standards
EPA	United States Environmental Protection Agency
FAC	Project Planning and Facility Operations, Maintenance, and Rehabilitation
HUD	Housing and Urban Development
IDC	Interest during construction
M&I	Municipal and Industrial
NPS	National Park Service
NRA	National Recreation Area
O&M	Operations and Maintenance
OWRB	Oklahoma Water Resources Board
REAP	Rural Economic Action Plan
RWD	Rural Water District
RWS	Rural Water Supply
USACE	U.S. Army Corps of Engineers
USDA	United State Department of Agriculture
USGS	United States Geologic Survey

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INTRODUCTION

Background and Authority

This Appraisal Report (Report) documents the findings of an Appraisal Investigation (Investigation) conducted by the Bureau of Reclamation (Reclamation) on behalf of the City of Sulphur (Sulphur), Oklahoma under Title I of Reclamation's Rural Water Supply (RWS) Program. The RWS Program was authorized by the Reclamation Rural Water Supply Act of 2006 (Act; Public Law 109-451). The Act authorized Reclamation to establish a program to work with rural communities and tribes throughout the 17 western United States to assess potable water supply needs and to identify options to address those needs through appraisal investigations and feasibility studies. The program is administered in accordance with Interim Final Rule 43 CFR Part 404 and Reclamation's Directives and Standards (CMP 09-03), both of which set forth programmatic standards governing eligibility, prioritization criteria, and specific content and review requirements of appraisal investigations and feasibility studies conducted under the program. Detailed information can be found at *www.usbr.gov/ruralwater*.

Funds for this Report and accompanying Investigation were provided through a competitive grant under Funding Opportunity Announcement R11SF80307 using Fiscal Year 2011 appropriations. A total of $190,063 was awarded to Sulphur, which subsequently allocated those funds through a Memorandum of Agreement (dated July 2011) to Reclamation's Oklahoma-Texas Area Office to conduct the Appraisal Investigation.

Consultation and Coordination

This Report and Investigation were carried out in coordination with several Federal, State, tribal, and local stakeholders to: (1) Ensure that resources were leveraged and that duplicative efforts, as applicable, were avoided; (2) Maintain transparency and accountability for methods and approaches employed throughout the planning process; and (3) Improve the credibility and value of Reclamation's findings and recommendations. The following stakeholders were identified and consulted with throughout this investigation: (1) Arbuckle Master Conservancy District; (2) National Park Service; (3) Chickasaw Nation; (4) Oklahoma Water Resources Board; (5) Oklahoma Department of Wildlife Conservation; (6) Murray County Rural Water District (RWD) No. 1; and (7) Buckhorn RWD; and (8) Citizens for the Protection of the Arbuckle Simpson Aquifer. Consultation with representatives from U.S. House Representative Tom Cole (R - 4th District) also occurred throughout the process.

The following stakeholder meetings were held:

1. August 18, 2011: A kick-off meeting with stakeholders was held to provide an overview and solicit feedback about Reclamation's Rural Water Supply Program, the draft scope of work for the investigation, and on expectations regarding roles, responsibilities, information sharing, and timeframes.
2. October 25, 2011: Assess Murray County RWD No. 1 and Buckhorn RWD's need and/or interest in having its supplies and demands evaluated in this investigation.
3. January 26, 2012: A meeting with stakeholders was held to discuss and solicit feedback on the methods and results of Reclamation's preliminary screening analysis and alternatives evaluation.

4. April 30, 2013: A meeting with stakeholders was held to discuss and solicit feedback on the results of investigation, including selection of a preferred conveyance alternative, costs, benefits, and financial capability. Also discussed were options moving forward in terms of scoping and financing a feasibility-level investigation.

In an effort to inform the general public about the investigation, Reclamation hosted a public meeting at Sulphur's City Hall on August 12, 2013 and presented an overview on the results of the appraisal investigation and solicited feedback on the findings and recommendations. Public comments were documented and will be considered as additional planning studies are undertaken in the future.

Rural Water Supply Program Background and Process Overview

Reclamation has significant experience in the development of rural water projects. Since 1980, Congress has directed Reclamation to undertake 10 specific rural water projects, and Reclamation has a century of experience developing and managing water delivery systems in the West. However, prior to the passage of the Act in 2006, Reclamation did not have a formal rural water program. The program in place now, as established by the Interim Final Rule, allows Reclamation to be involved in planning and prioritizing rural water projects to ensure that the projects selected are cost-effective and that they are in the Federal interest.

The method by which Reclamation selects projects for implementation is centered on a two-step planning process that includes development of an appraisal investigation (Step I) and a feasibility study (Step II). An appraisal investigation uses existing data to analyze the water supply problems, needs, and opportunities in the planning area, includes a preliminary-level assessment (i.e., viability analysis) of alternatives to address those needs, and determines if there is at least one viable alternative that warrants a more detailed investigation through a feasibility study. A completed appraisal report provides the basis by which Reclamation may recommend proceeding to a feasibility study. A feasibility study is a detailed investigation requiring the acquisition of data, an in-depth analysis on the technical and economic feasibility of a proposed alternative, an environmental impact analysis pursuant to the National Environmental Policy Act, and a formal assessment of the project sponsor's financial capability to pay the non-Federal share of project construction, operations, and maintenance. A completed feasibility study provides the basis for whether Reclamation may make a recommendation to Congress for authorization to construct a project. The specific content requirements of both appraisal investigations and feasibility studies are included in Reclamation's Directives and Standards CMP 09-03 (*http://www.usbr.gov/recman/cmp/cmp09-03.pdf*).

Appraisal Report Purpose

The purpose of this Report is to document Reclamation's findings associated with an Investigation conducted to (1) identify problems, needs, and opportunities in the investigation area; (2) formulate and evaluate a range of potentially viable alternatives to meet identified planning objectives, (3) determine which alternative is viable and thereby recommended as a proposed alternative; (4) develop an appraisal-level design and cost estimates on the proposed alternative; (5) assess benefits and costs of the project; and (6) evaluate financial capability of project sponsors to afford project construction and implementation.

The purpose of this Report also is to apply the criteria set forth under Interim Final Rule 43 CFR §404.44 in determining whether it is appropriate to recommend that a feasibility study be conducted under the Rural Water Supply Program.

PROBLEMS, NEEDS, AND OPPORTUNITIES

Resources

The Bureau of Reclamation's Arbuckle Project is located in south-central Oklahoma in Murray County near Sulphur (Figure 1). The Project was authorized in 1962 by P.L. 87-594 for the purposes of storing, regulating, and providing water for municipal, domestic, and industrial use; flood control; fish and wildlife use; and the enhancement of recreation. The Act authorized the following features: Arbuckle Dam and Reservoir; a system of two pipelines to deliver water to Ardmore, Dougherty, Davis, Wynnewood, a refinery at Wynnewood, and the Ardmore Air Park industrial site; and two pumping plants. All of these features have been constructed and are in operation. A third pipeline was authorized to deliver water to Sulphur, which has an existing contract with the Arbuckle Master Conservancy District for 1,997 acre-feet/year of surface water stored within the Lake of the Arbuckles[1]. However, because Sulphur had an adequate groundwater supply which required minimal treatment, it elected not to build the pipeline at that time, so the infrastructure necessary to deliver the water to Sulphur does not currently exist.

The Arbuckle-Simpson Aquifer underlies six counties and about 500 square miles of south-central Oklahoma. It is an Environmental Protection Agency-designated sole source aquifer for the cities of Ada and Sulphur, and is the source of water for a number of important springs and streams in the region, including those associated with Reclamation's Arbuckle Project, Chickasaw National Recreation Area (NRA), and the Chickasaw Nation. The aquifer provides an ideal geographic setting for a regional water supply system that is connected both physically and hydrologically. At the same time, the setting provides an opportunity to manage conjunctive uses of both surface and groundwater in an area where there is a need to reduce groundwater pumping.

The Chickasaw NRA, administered by the National Park Service (NPS), was originally authorized in 1902 as Sulphur Springs Reservation and was renamed and redesignated as Platt National Park in 1906. In 1976, Platt National Park, the Arbuckle NRA, and additional lands were combined to establish the Chickasaw NRA. Its name honors the Chickasaw Nation, who were relocated to the area from the southeastern U.S. during the 1830s (and who later sold the original 640 acres of land for the park to the Federal government). Surrounding what is now Lake of the Arbuckles, the Chickasaw NRA provides an abundance of wildlife habitat, as well as opportunities for wildlife viewing, swimming, boating, fishing, picnicking, camping, and hiking. One of the major attractions to the Chickasaw NRA is water. Located in southern Oklahoma, the park offers mineralized and freshwater springs, clear streams, and lakes. The springs are located throughout the Travertine District in the northeastern section of the Chickasaw NRA and provide numerous ecosystem, recreation, and cultural benefits. The number of springs and the volume of their flow have varied over the years and is a matter of great concern for many stakeholders, especially the NPS and Chickasaw Nation. The springs are fed by the Arbuckle-Simpson Aquifer, which is recharged by local rainfall. Artesian pressure forces the water upward through cracks and fissures to form prominent freshwater springs such as Buffalo Springs and Antelope Springs, which serve as a primary source of Travertine Creek and Rock Creek, which contribute significant flows into Lake of the Arbuckles.

[1] The contract between the District and Sulphur includes Sulphur's proportionate share of Arbuckle Project construction and O&M costs and does not include separate cost for water.

Lake of the Arbuckles is formed by Arbuckle Dam, which regulates flows of Rock Creek. The reservoir has a total capacity of 108,839 acre-feet at elevation 885.3 and an active conservation capacity of 62,571 acre-feet at elevation 872.0. The surface area of the reservoir is 3,127 acres at elevation 885.3. With 36 miles of shoreline and protective coves, Lake of the Arbuckles is widely known as one of the best fisheries in Oklahoma, supporting catfish, perch, bass, and crappie. Together, the Chickasaw NRA with Lake of the Arbuckles support over 1.2 million recreation visitors per year.

Another prominent feature of the area is the Chickasaw Cultural Center, the largest tribal cultural center in the United States. The Cultural Center sits on 109 acres and has 96,000 square feet of buildings, including a welcome center, gift shop, research center, theater and café, exhibit center, honor garden, amphitheater, and a traditional village. The Chickasaw Nation also is in the process of constructing a hotel, gaming center, and botanical gardens. Combined, the Chickasaw NRA and Chickasaw Cultural Center bring an estimated four million visitors to Sulphur annually, which brings a significant economic benefit to the city and the region.

Figure 1. Study Area.

Problems and Needs

The problems and needs in the study area stem from water supply deficits that will occur from groundwater pumping restrictions on the Arbuckle-Simpson Aquifer as ruled by the state of Oklahoma, as well as the long-term environmental, recreational, and cultural impacts associated with the potential development of new groundwater supplies. If pumping restrictions on the Arbuckle-Simpson Aquifer are in place by 2018[2], a water supply deficit for Sulphur would occur around 2030. For other entities in the area, this deficit would occur immediately. Several entities in the region, including Sulphur, RWDs, and Ada, currently utilize groundwater supply from the Arbuckle-Simpson Aquifer for their drinking water. In recognition of the aquifer's historical, environmental, cultural, and recreational significance, and in response to proposals to transfer groundwater out of the basin, state legislation (Senate Bill 288) was enacted that mandated an evaluation of the impacts of groundwater pumping on the aquifer and its associated springs, streams, and lakes. The Oklahoma Water Resources Board (OWRB), in collaboration with Reclamation, U.S. Geological Survey (USGS), NPS, and several local entities, completed a seven-year study in 2010 on the hydrology of the Arbuckle-Simpson Aquifer (OWRB and USGS 2011). Following the study, the OWRB issued a Final Determination of Maximum Annual Yield ordering a 0.2 acre-foot per acre per year equal proportionate part of the yield to be allocated to each surface acre overlying the aquifer (OWRB 2013). This represents a *90 percent* reduction from the current temporary pumping rates of 2.0 acre-feet per acre. The Final Determination also stipulates a *five year* timeframe for the new permitting requirements[3].

Therefore, many entities, including Sulphur, that currently depend on the aquifer, are seeking alternative surface water supply options in preparation for future pumping restrictions. These alternative supplies will not only help meet future water needs, they will potentially help mitigate long-term impacts on the numerous resources associated with the Arbuckle-Simpson Aquifer.

Existing and Projected Supplies and Demands

Reclamation's Rural Water Supply Program encourages project sponsors to incorporate a watershed approach to water resources planning efforts that considers regional solutions to meeting the demands of multiple entities in an area. The first step in this approach was to perform a regional needs assessment to identify the extent to which needs exist in the area beyond Sulphur and how those needs relate to supplies, with a particular focus on identifying entities that currently rely on groundwater as their sole supply. For the purposes of this assessment, a 40-mile radius was selected as the cut off range in consideration of the geographic extent of the Arbuckle-Simpson Aquifer.

A total of 55 water providers were identified within the 40-mile radius. Using the Oklahoma Comprehensive Water Plant, pertinent data on projected demands, existing water rights, and supply sources were collected. Water providers were then ranked based on relative need (1 = greatest need) using factors related to demand increases, water right exceedances, water and infrastructure needs, proximity to Sulphur, and groundwater use. According to the regional needs assessment, Murray County RWD No. 1 ranked the highest, followed by Buckhorn RWD, which currently purchases its water from Murray County RWD No. 1. Both RWDs are adjacent to Sulphur to the

[2] A Final Order on the Determination of the Maximum Annual Yield of the Arbuckle Simpson-Aquifer was issued on October 23, 2013, and includes a five year timeframe for implementation.

[3] The five year timeframe begins after the effective date of a final order determining the maximum annual yield.

north and east, respectively. Figure 2 includes a map which depicts the results of the regional assessment's ranking analysis.

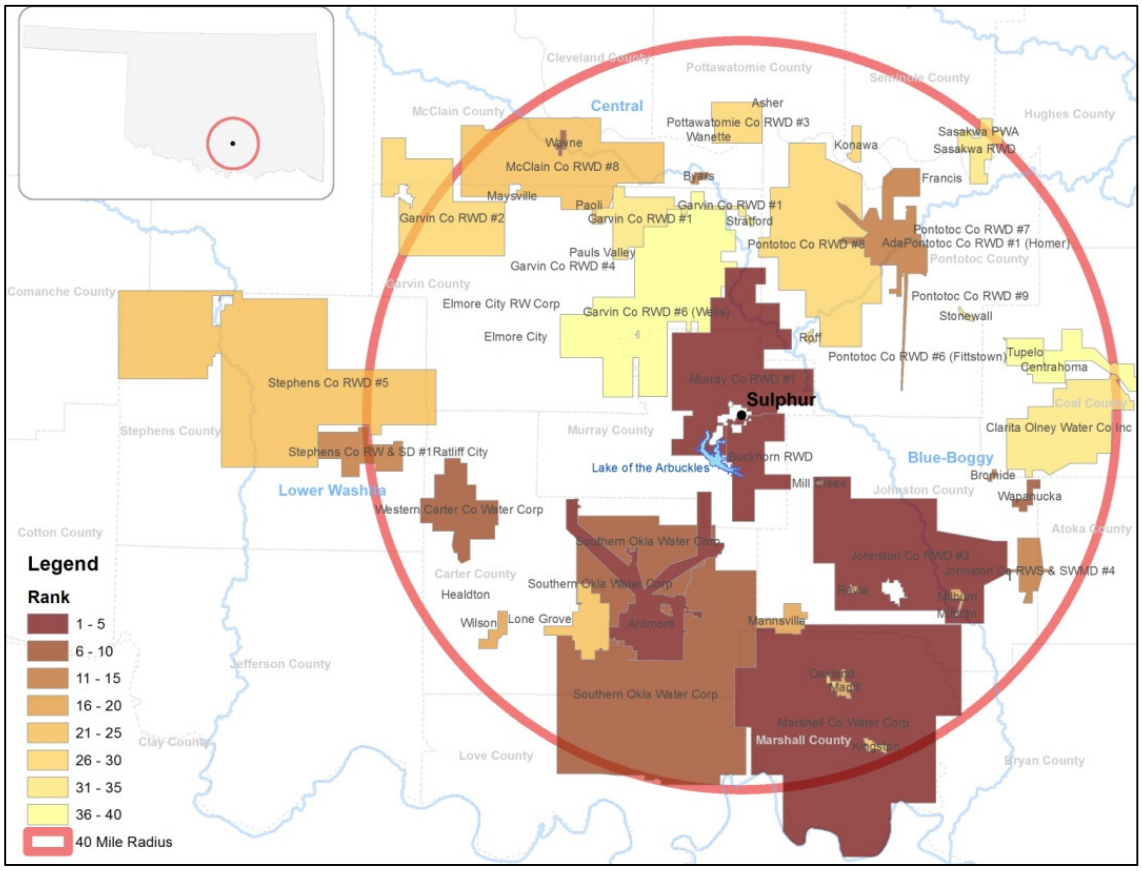


Figure 2. Map showing the results of a regional water needs assessment to identify potential customers that could purchase water from Sulphur.

Considering the fact that the other water providers which scored as high as Murray County RWD No. 1 and Buckhorn RWD were not adjacent to Sulphur, it was decided to exclude those from further analysis and to focus only on the supplies and demands of Murray County RWD No. 1. Murray County RWD. No. 1 also sells water to Buckhorn RWD and the town of Dougherty[4].

Pumping restrictions on the Arbuckle-Simpson Aquifer would result in a water supply deficit for Sulphur in 2030 that would grow to 295 acre-feet per year by 2060. For Murray County RWD No. 1 and Buckhorn RWD, a water deficit would occur immediately and grow to 1,144 acre-feet per year by 2060. Water conservation measures, as described in the Appraisal Investigation, would reduce this deficit slightly by 2060. Assuming pumping restrictions are in place by 20180[5], the combined supplies and demands for Sulphur and Murray County RWD No. 1 indicate that a supply deficit would exist immediately upon pumping restrictions and would grow to about 1,439 acre-feet per year by 2060. This deficit could be reduced, but not eliminated, through long-term water conservation measures aimed at reducing per capita day usage. Figure 3 below illustrates the combined supplies and demands of Sulphur, along with both RWDs, both with and without water

[4] Dougherty also has a contract with Arbuckle Master Conservancy District for 112 acre-feet per year of water.
[5] The five year timeframe begins after the effective date of a final order determining the maximum annual yield.

conservation measures. Assumptions, as well as detailed data for Sulphur and Murray County RWD No. 1 supplies and demands are provided in Chapter I of the Appraisal Investigation.

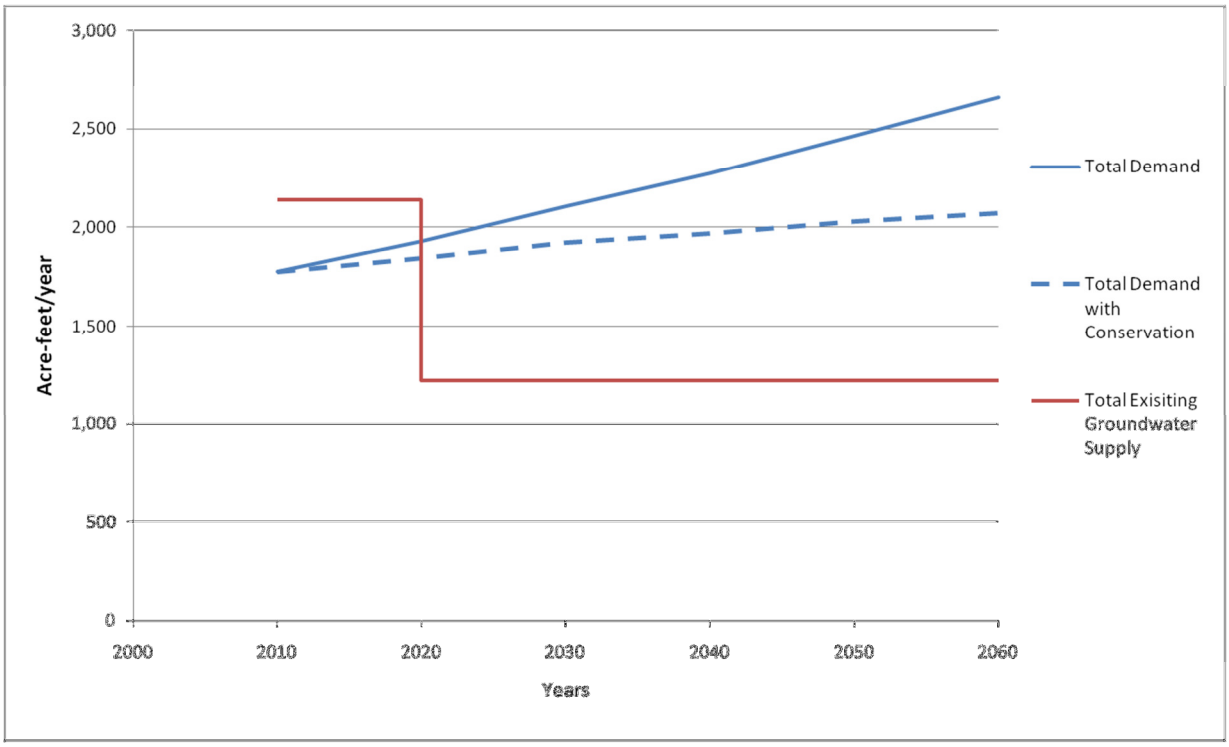


Figure 3. Existing and projected supplies and combined demands for Sulphur and Murray County RWD No. 1, both with and without water conservation. Projections assume a 90 percent reduction in temporary groundwater rights. Buckhorn RWD and Dougherty demands are included.

Opportunities

The recent groundwater permitting restrictions has created a unique opportunity for Sulphur to collaborate with other stakeholders in the region on a study to evaluate the viability of developing surface water supply options that meet the immediate and long-term water supply needs of the area. At the same time, these options would reduce long-term pumping rates on the Arbuckle-Simpson Aquifer and help avert any potential adverse impacts on the economic, recreational, historic, cultural, and natural resources associated with the aquifer.

An opportunity also exists to fulfill the Arbuckle Project's original Congressionally-authorized purpose of providing water to five entities in the region, *including Sulphur*. As previously stated, Reclamation's Arbuckle Project consists of Arbuckle Dam and Reservoir; a system of two pipelines to deliver water to Ardmore, Dougherty, Davis, Wynnewood, a refinery at Wynnewood, and the Ardmore Air Park industrial site; and two pumping plants. A third pipeline was authorized to deliver water to Sulphur, which has an existing contract with the Arbuckle Master Conservancy District for 1,997 acre-feet per year of surface water stored within the Lake of the Arbuckles. However, the pipeline was never built so the infrastructure necessary to deliver the water to Sulphur does not exist. Coincidentally, the 1,997 acre-feet per year of surface water available from Lake of the Arbuckles is more than enough to meet the 2060 water supply needs of Sulphur and Murray County RWD No. 1 (1,439 acre-feet per year).

The fact that Sulphur has an existing surface water right allocation from Lake of the Arbuckles, which is more than enough to meet its long-term water supply needs, sets up the opportunity for Sulphur to become a wholesale water provider in the area. According to Reclamation's regional needs assessment, Murray County RWD No. 1 (and its customers) is an excellent candidate to participate in a project to develop infrastructure from Lake of the Arbuckles. Sulphur, along with Murray County RWD No. 1, expressed an interest in this arrangement and thus requested that Reclamation include the needs of Murray County RWD No. 1, including its customers (Buckhorn RWD and Dougherty) in its infrastructure assessment for the area. Furthermore, given the previously cited demand projections of all three entities, Sulphur would still have a 558 acre-feet per year water surplus in 2060. This creates additional opportunities for Sulphur to sell water to other customers and further mitigate potential adverse impacts on the aquifer.

The NPS and Chickasaw NRA are highly supportive of this appraisal investigation and support development of Lake of the Arbuckles' Sulphur water right allocation thereby decreasing long-term demands on groundwater supplies. This may potentially improve flow in the springs and streams in the Chickasaw NRA. These water sources are critical to sustaining the local ecosystem, preserving the Chickasaw Nation's rich cultural heritage, and maintaining the economic viability of the area.

Planning Objective

In consideration of the problems, needs, and opportunities in the investigation area, the planning objective of this appraisal investigation is to reduce long-term pumping from the Arbuckle-Simpson Aquifer through development of a surface water supply alternative that conveys water to Sulphur and provides at least 707 acre-feet per year of water to Sulphur and Murray Co. RWD No. 1 by 2020, and at least 1,439 acre-feet per year of water by 2060.

ALTERNATIVES FORMULATION AND EVALUATION

Alternatives were formulated based on their ability to meet the planning objective of reducing long-term pumping of the Arbuckle-Simpson Aquifer through use of existing surface water supplies. The alternatives evaluated would convey water to Sulphur and provide at least 707 acre-feet per year of water to Sulphur and Murray Co. RWD No. 1 by 2020, and at least 1,439 acre-feet per year of water by 2060.

The No Action (Future without the project) alternative was identified as the most likely scenario to meet water supply needs if the Project was not implemented. In the absence of the Project, some type of water conservation/restriction measures would be required as well as acquisition of additional groundwater water rights. Preliminary investigations, discussed in Chapter II of the Appraisal Investigation, indicate that water conservation alone would not bridge the full 1,439 acre-foot (847 acre-feet with conservation) gap between supply and demand that is projected by the year 2060 in the service area. For the purposes of this preliminary analysis, it was assumed that acquisition of groundwater rights would occur either directly through purchase/leasing of water rights or indirectly through purchasing/leasing land. The amount of land needed to secure 1,439 acre-feet per year of water rights in 2060 was estimated to be 7,195 acres; the amount of land needed to secure 847 acre-feet per year of water rights in 2060 was estimated to be 4,235 acres.

In addition to the No Action (future without the project), four water supply sources were identified as potentially meeting this planning objective: (1) Washita River, (2) Veterans Lake, (3) water reuse and recycling, and (4) Lake of the Arbuckles. Results of this viability analysis support Lake of the Arbuckles being selected as the proposed alternative water supply source for Sulphur. Subsequently, ten alternatives were formulated to pump, treat, and convey water from Lake of the Arbuckles to Sulphur. These alternatives were evaluated and compared using established ranking criteria based on effectiveness, efficiency, acceptability, and completness. Detailed results of the conveyance alternatives screening analysis are provided in Chapter II of the Appraisal Investigation.

Recommended Conveyance Alternatives

Alternative 9, as presented in detail within the accompanying Appraisal Investigation, received the highest scores across all four criteria and is therefore recommended as the proposed conveyance alternative. Under Alternative 9, 1,997 acre-feet per year would be released through the existing intake structure at Lake of the Arbuckles and pumped through the existing Wynnewood Aqueduct to the existing regulating reservoir, both of which are owned by the Arbuckle Master Conservancy District. Water would then be pumped through a new pipeline to a new treatment and storage facility at the southwest corner of Sulphur's municipal water system along Chickasaw Trail and State Highway 7.

Two conveyance alternatives to deliver water from Sulphur to Murray County RWD No. 1 were formulated and evaluated. The proposed conveyance alternative is to construct a new pipeline from Sulphur water main to the Murray County RWD No. 1 standpipe, which would enable indirect delivery to Buckhorn RWD and Dougherty, which currently purchase their water from Murray County RWD No. 1.

Together, the proposed conveyance alternatives to deliver water from Lake of the Arbuckles to Sulphur and on to Murray County RWD No. 1 comprise the "**Sulphur Pipeline Regional Rural Water Supply Project" (Project)**, as illustrated in Figure 4.

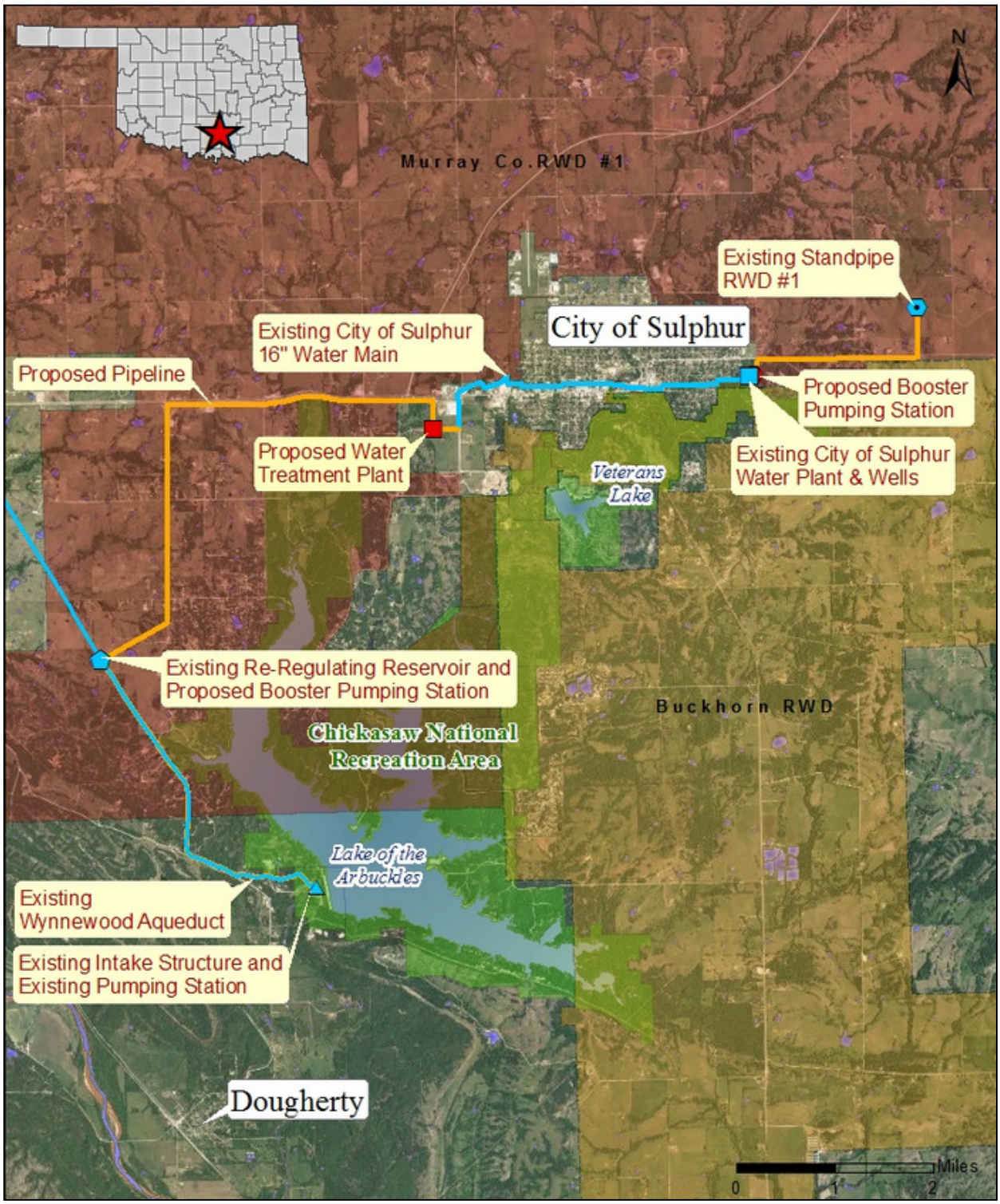


Figure 4. An illustration of the Sulphur Pipeline Regional Rural Water Supply Project.

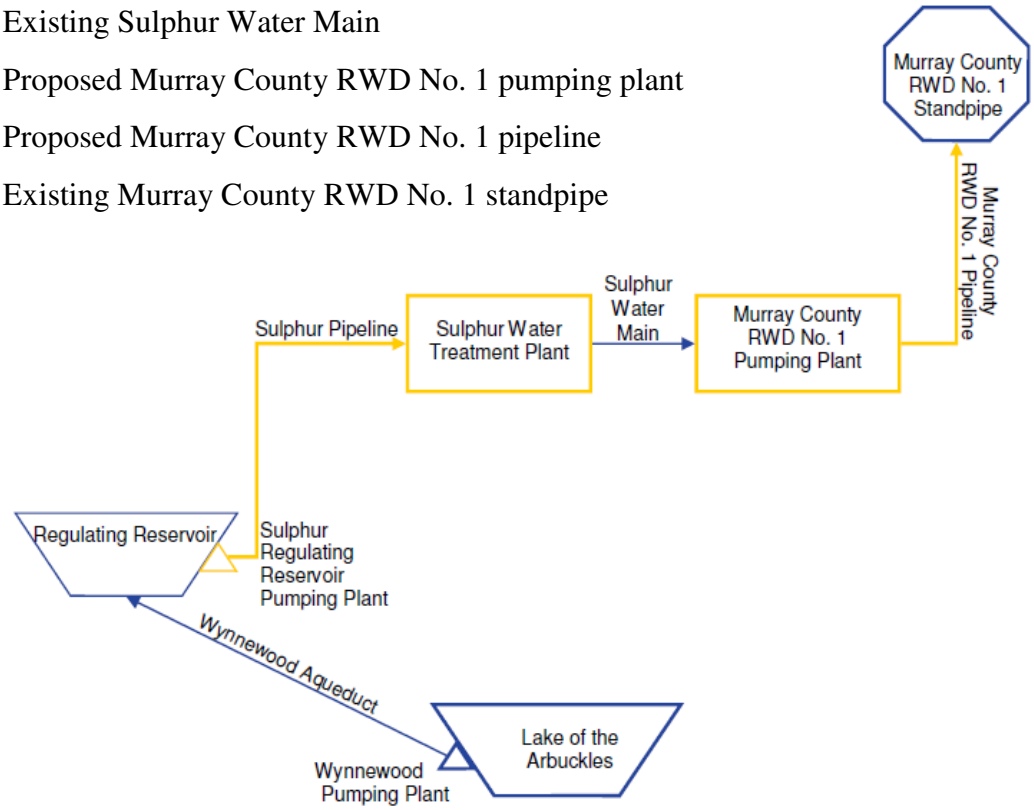
Appraisal-Level Design and Cost Estimates

Detailed design narratives for the proposed Project are provided in the accompanying Appraisal Investigation and presented in the order by which water would flow from Lake of the Arbuckles to Sulphur and on to the Regional Connection. For each major project feature, a description of the details, assumptions, risk factors, and additional considerations (as applicable) is provided for the three design components: (1) structural/architectural; (2) mechanical/hydraulic; and (3) electrical. Designs represent state-of-the-art technologies and incorporate components that reduce energy use and increase energy efficiency where possible.

A list and conceptual illustration of major project features is below. Existing facilities are shown in blue, and proposed facilities are shown in gold:

Project Features

- Existing Wynnewood pumping plant
- Existing Wynnewood Aqueduct
- Existing Regulating Reservoir
- Proposed Sulphur regulating reservoir pumping plant
- Proposed Sulphur pipeline
- Proposed Sulphur water treatment plant
- Existing Sulphur Water Main
- Proposed Murray County RWD No. 1 pumping plant
- Proposed Murray County RWD No. 1 pipeline
- Existing Murray County RWD No. 1 standpipe



Cost Summary and Methods

Table 1 below provides a summary of project cost estimates. Assumptions, as well as detailed quantity estimates for each project feature and totals are provided in Chapter III and Appendix D of the Appraisal Investigation.

Table 1. Summary of appraisal-level cost estimates for the Sulphur Pipeline Regional Rural Water Supply Project. Costs are provided for conveying water from Lake of the Arbuckles to Sulphur (i.e., "Lake to Sulphur) and from Sulphur to Murray County Rural Water District No. 1 (i.e., "Regional Connection").

Components	Infrastructure Totals		
	Lake to Sulphur	Regional Connection	Total
Wynnewood Pumping Plant	$1,050,000	$ -	$1,050,000
Wynnewood Pumping Plant and Pipeline (Proportionate Share)	$480,000	$ -	$480,000
Regulating Reservoir Outlet Structure and Pumping Station	$1,100,000	$ -	$1,100,000
Pipeline (pipe, earthwork, and structures)	$1,900,000	$430,000	$2,330,000
Sulphur Water Treatment Plant	$5,800,000	$ -	$5,800,000
Murray County RWD No. 1 Pumping Plant	$ -	$530,000	$530,000
Land Cost	$70,000	$30,000	$100,000
Subtotal	*$10,400,000*	*$990,000*	*$11,390,000*
Contract Costs[1]	$2,700,000	$260,000	$2,960,000
Construction Contingencies	$3,300,000	$310,000	$3,610,000
Non-Contract Costs[2]	$2,500,000	$240,000	$2,740,000
Total Construction Cost	**$18,900,000**	**$1,800,000**	**$20,700,000**
Annual O&M Cost	**$410,000**	**$16,000**	**$426,000**
Lifecycle O&M Cost	$20,500,000	$800,000	$21,300,000
Annualized Construction Cost per 1000 gallons	$1.30	$0.20	$1.50
Annual O&M Cost per 1000 gallons	$0.63	$0.04	$0.67
Annualized Life-Cycle Cost per 1000 gallons	$1.93	$0.24	$2.17

[1] Contract costs includes: Mobilization, Design Contingencies, and Allowance for Procurement Strategies
[2] Non Contract costs includes: Feasibility Study, Environmental Compliance, Engineering Designs, and Construction Management

Origin and Source of the Cost Estimates

Reclamation has established requirements and procedures for developing cost estimates. These are set forth in Directives and Standards (D&S) Project Planning and Facility Operations, Maintenance, and Rehabilitation (FAC) 09-01, *Cost Estimating* and D&S FAC 09-02, *Construction Cost Estimates and Project Cost Estimates*, and FAC 09-03, *Representation and Referencing of Cost Estimates*.

Preparers and Reviewers

Cost estimates for the replacement pumps, intake/pump station, and Water Treatment Plant/booster pump station were prepared and reviewed by Reclamation's Technical Service Center Estimating Group (86-68170) in Denver, Colorado. Cost estimates for structural and mechanical components were prepared by Ian Bailey, Civil Engineer; checked by Ngoc Dam; and peer reviewed by Thomas Hanke, Civil Engineer. Cost estimates for electrical components were prepared by Ngoc Dam, Electrical Engineer (86-68430); checked by Ian Bailey, and peer reviewed by Loran Zlomke, Electrical Engineer (86-68170).

Cost estimates for the conveyance pipeline and appurtenances were prepared by Matt Warren, Supervisory Civil Engineer, checked by Anna Hoag, Civil Engineer, and reviewed by James Allard, Deputy Area Manager, all from Reclamation's Oklahoma-Texas Area Office.

The names of preparers and reviewers for all cost estimates, as well as associated quantities, can be found within the quantity worksheets provided in Chapter III and Appendix D of the Appraisal Investigation.

Purpose and Intended Use of the Cost Estimates

The cost estimates are considered "appraisal-level", as defined by D&S FAC 09-01, which states: "appraisal cost estimates are used in appraisal reports to determine whether more detailed investigations of a potential project are justified. These estimates may be prepared from cost graphs, simple sketches, or rough general designs which use the available site-specific design data". Appraisal-level costs estimates are developed at an early stage of project development and are therefore not suitable for requesting project authorization or construction fund appropriations from Congress.

Basis of Cost Estimate

The unit prices are based on historical, bid, and industry reference costing data. Due to the effect of current material pricing, manufacturer quotes were obtained on the following significant cost drivers: Sludge Belt press Dewatering System; Packaged Water Treatment System; and Hydraulic Transient Mitigation System – bladder style air chamber.

Price Level

All costs are in July 2012 dollars.

Operations and Maintenance (O&M) Costs

The O&M of basic features such as the pumping plant, pipeline, and terminal storage facility were derived, in part, from actual O&M of the existing Wynnewood Aqueduct by the Arbuckle Master Conservancy District over the past three years. Actual O&M costs would vary depending on negotiated rates and quality of constructed features. A detailed description of the methods and assumptions used to develop O&M costs is provided in Chapter III of the Appraisal Investigation.

Economics and Benefits Analysis

A comparison of project benefits and costs was conducted as part of this investigation in accordance with requirements of 43 CFR §404.44. Two approaches were used to quantify project benefits: (1) Cost of No Action and (2) Willingness to Pay. Benefits associated with environmental and recreational resources also were evaluated, but they were not quantified in terms of being project-associated. The methodologies and results are discussed in Chapter IV of the Appraisal Investigation.

Cost of No Action (Future without the Project)

The Cost of No Action entails identifying the costs that would be expended to meet water supply needs if the Project was not implemented. This avoided cost can be considered as a benefit of the project because it is a resource cost saved that would be available for use elsewhere (a reduced opportunity cost). In the absence of the Project, some type of water conservation/restriction measures would be required as well as acquisition of additional groundwater water rights. Preliminary investigations, discussed in Chapter II of the Appraisal Investigation, indicate that water conservation alone would not bridge the full 1,439 acre-foot (847 acre-feet with conservation) gap between supply and demand that is projected by the year 2060 in the service area. For the purposes of this preliminary analysis, it was assumed that acquisition of groundwater rights would occur either directly through purchase/leasing of water rights or indirectly through purchasing/leasing land. The amount of land needed to secure 1,439 acre-feet per year of water rights in 2060 was estimated to be 7,195 acres; the amount of land needed to secure 847 acre-feet per year of water rights in 2060 was estimated to be 4,235 acres. The present land value was calculated using a planning rate of 3.75 percent under the assumption that Sulphur and Murray County RWD No. 1 would purchase enough land to meet projected deficits that may occur each decade, both with and without implementation of water conservation measures (Table 2).

Willingness to Pay (Domestic Benefits)

A commonly used measurement standard for valuing goods and services is the willingness of users to pay for each increment of output from a plan. Willingness to pay can be defined as the dollar amount that an individual or firm is willing to give up or pay, *above and beyond the actual amount currently being paid*, to acquire a good or service. This measurement standard is applied to all water related resources, including municipal and industrial (M&I) water supplies.

The benefits transfer approach was used in this willingness to pay analysis to estimate the domestic benefits of the Sulphur Pipeline Regional Rural Water Supply Project. Application of the benefit transfer method assumes that the relationship between a resource improvement and economic value in one area can be estimated and applied to another geographic area or resource. The accuracy of benefits transfer based estimates is dependent on the similarity of the site where the original detailed analysis was completed and the site of interest where the transferred benefits are applied. Similarity can be defined in terms of economic conditions, population characteristics, resources within an area, or other characteristics.

The source of information used to estimate the domestic water supply benefits of the Sulphur Pipeline Regional Rural Water Supply Project was a previously completed survey on a study of

the benefits associated with the a proposed northwest Oklahoma Water Supply Project (Piper and Martin, 1997). The survey asked for the willingness of households to pay for a water supply system that would reduce groundwater overdraft in the region. Recognizing that differences certainly exist between the northwest and southcentral Oklahoma (the current study area), the survey represents the best available known data for this approach in that project concept generally could be representative of the groundwater overdraft situation in the Sulphur area. Details are provided in Chapter IV of the Appraisal Investigation.

Table 2. Present value range of total quantified project benefits over 50 years, Sulphur Pipeline Regional Rural Water Supply Project.

	No Action; Future without Project[1]		Domestic Benefits		Total Quantified Benefits[4]	
Entity	**Low[2]**	**High[3]**	**Low**	**High**	**Low**	**High**
Sulphur	N/A[5]	$900,000	$9,100,000	$13,500,000	$9,100,000	$14,500,000
Murray County RWD No. 1	$1,250,000	$7,400,000	$9,800,000	$14,500,000	$11,000,000	$22,000,000
Total	$1,100,000[6]	$8,500,000	$18,900,000	$27,000,000	$20,000,000	$36,000,000

[1] Based on amount of land needed assuming a 0.2 acre-feet per acre equal proportionate share
[2] Assumes future with conservation measures, as well as the lowest estimated cost per water right.
[3] Assumes future without conservation measures, as well as the highest estimated cost per water right.
[4] Small difference in total due to rounding.
[5] With water conservation measures in place, a water surplus of 162 acre-feet per year in 2060 is expected for the City of Sulphur, so project benefits associated with acquisition of land for water rights are not applicable.
[6] Sulphur's expected 2060 water supply surplus with conservation would decrease the overall project benefits associated with acquisition of land for water rights when combined with Murray County RWD No. 1.

Unquantified Recreation/Environmental Benefits

A preliminary assessment also was performed on the potential future lost benefits resulting from the impacts of continued groundwater withdrawal on springs and other nearby resources was evaluated. A detailed quantitative analysis was not performed because it was beyond the scope of this investigation. The current level of recreation use at the Chickasaw NRA, along with the value of that use, was evaluated to measure of the magnitude and importance of recreation and environmental resources in the area that could ultimately be impacted by continued groundwater drawdown and associated impacts on springs and other resources.

Using the NRA visitation data, along with regional data sources on the value of various recreation and non-recreation activities, the total annual economic value of the Chickasaw NRA was estimated (Table 3). Details of this analysis are provided in Chapter IV of the Appraisal Investigation.

Table 3. Visitation and estimated economic value of recreation at Chickasaw NRA

Recreation activity	Average 2009 to 2011 visitation	Estimated recreation days	Value per day in 2012 dollars		Total annual recreational value in 2012 dollars	
			Low	High	Low	High
Camping	70,805	270,120	$32		$8,600,000	$8,600,000
Boaters and boats	37,877	70,070	$67	$72	$4,700,000	$5,000,000
Other recreation	1,126,071	2,083,230	$38	$52	$79,200,000	$108,300,000
Total	**1,234,753**	**2,423,420**	**-**	**-**	**$92,500,000**	**$121,900,000**

Based on these values, it appears that an impact on resources that translates into a change in visitation at the Chickasaw NRA will result in approximately a $1.0 million impact on recreational value each year for each one percent of visitation change. It should be noted that this analysis is preliminary and based on the benefits transfer approach that assumes recreation values based on broad regional surveys. A more accurate estimate of recreation and environmental values would entail a more localized analysis and a survey of resources in the study area. Even though quantifying the resources that could potentially be adversely impacted by continued groundwater pumping is beyond the scope of this investigation, Chapter IV of the Appraisal Investigation provides a summary of preliminary calculations on the cumulative volume of groundwater that would be pumped from the Arbuckle-Simpson Aquifer under three different implementation scenarios.

Project Costs

The appraisal-level capital and O&M costs for the Sulpur Pipeline Regional Rural Water Supply Project are presented in detail within Chapter III of the Appraisal Investigation. O&M costs were converted to a present value based on a 50-year period and a project interest rate of 3.75 percent. Interest during construction (IDC), which accounts for costs incurred when project construction begins until the project is brought into service, were calculated. Total Sulphur Pipeline Regional Rural Water Supply Project Construction, O&M, and IDC costs are shown in Table 4.

Table 4. Total Sulphur Pipeline Rural Water Supply Project Costs. Costs are provided for conveying water from Lake of the Arbuckles to Sulphur (i.e., "Lake to Sulphur) and from Sulphur to Murray County Rural Water District No. 1 (i.e., "Regional Connection").

Category of Cost	Lake to Sulphur	Regional Connection	Total
Construction cost	$18,900,000	$1,800,000	$20,700,000
Present value of annual O&M costs	$9,500,000	$400,000	$9,900,000
Interest during construction	$1,100,000	$100,000	$1,200,000
Total project cost	**$29,500,000**	**$2,300,000**	**$31,800,000**

Benefits and Costs Comparison

The present value of total project costs stated above is estimated to be $31.8 million. The present value of total quantified project benefits associated with avoided land costs and willingness to pay range from $20.0 million to $36.0 million. These values alone correspond to net positive economic benefits when considering the higher range of project benefits. Additional benefits also may exist that are associated with reducing future groundwater withdrawals and subsequent potential impacts to recreation and environmental resources. The value of recreation and environmental resources at the Chickasaw NRA were estimated to range from $92.11 to $122.73 million annually, which correspond to a present value of about $2 billion over the 50-year period of analysis. Quantifying the project benefits associated with those values was beyond the scope of this investigation. However, even a one percent benefit value would bring the net project benefits well above project costs.

Financial Capability Analysis

Under the Rural Water Supply Act, Reclamation has the authority to pay up to 75 percent of construction costs, dependent on financial capability of the project sponsor. Furthermore, 43 CFR §404.44 requires appraisal investigations to analyze whether the project sponsor has the capability to pay 100 percent of the costs associated with O&M. Results indicate that project sponsors could afford both 25 percent of construction costs and 100 percent of O&M.

The capability of water users to pay for M&I water supplies can be defined as the maximum amount water users can pay for water after accounting for household income, business revenues, and household or business expenses. Although no universal method exists for measuring payment capability or affordability for domestic water supplies, two general approaches have been used to estimate capability to pay. One common technique involves the use of an affordability threshold, which is measured as a percentage of median household income. Using this technique, threshold percentages of household income are applied to households in the study area to determine total water payment affordability. A second approach is based on an evaluation of a range of actual water payments made by households and businesses relative to household income after accounting for necessary expenses, and taking the upper end of the relative payment range.

For the Sulphur Pipeline Regional Rural Water Supply Project investigation, along with the United States Environmental Protection Agency (EPA) threshold of 2.5 percent of median household income, data from previously completed ability to pay analyses were used, including the Lewis and Clark Rural Water System (Piper and Martin, 1999), the Eastern New Mexico Rural Water System (Smith Engineering Company, 2003), and the Equus Beds Aquifer Storage Recharge and Recovery Project (Bureau of Reclamation, 2009). Discretionary income for the Sulphur Pipeline Regional Rural Water Supply Project water users was estimated using median or average household income data obtained from the U.S. Census Bureau American Consumer Survey five-year data for 2006 to 2010 and the Bureau of Labor Statistics, Consumer Expenditure Survey data (U.S. Bureau of Labor Statistics, 2012).

The range of estimated annual payment capability for the Sulphur Pipeline Regional Rural Water Supply Project water users is presented in Table 5.

Table 5. Average annual payment capability for users of the Sulphur Pipeline Regional Rural Water Supply Project over the 50 year period of analysis (Lowest, Highest, and Average).

Entity	EPA	Lowest Estimate[1]	Highest Estimate[2]	Average Estimate[3]
Sulphur	$2,500,000	$1,200,000	$4,500,000	$2,300,000
Murray County RWD No. 1	$2,400,000	$1,500,000	$4,400,000	$2,300,000
Buckhorn RWD	$520,000	$360,000	$960,000	$520,000
Dougherty	$280,000	$140,000	$510,000	$260,000
Total	**$5,700,000**	**$3,200,000**	**$10,500,000**	**$5,400,000**

[1]The lowest estimate represents the 3.21 percent threshold of discretionary income, which is the low end of the Lewis and Clark Project.
[2]The highest estimate represents the 13.09 percent threshold of discretionary income, which is the high end of the Equus Beds Project.
[3]The average estimate represents an average of the EPA threshold with five percentages taken from previously completed projects.

Affordability of the Sulphur Pipeline Regional Rural Water Supply Project was then determined by comparing the estimated annual payment capability to the combined annual costs of the Project and existing water service. Two options were analyzed: Option 1 assumes that infrastructure would be constructed to deliver water only to Sulphur and would be funded solely by Sulphur without a cost-share from Murray County RWD No. 1; Murray County RWD No. 1 would acquire and fund groundwater rights instead. Murray County RWD No. 1 in-turn would acquire and fund groundwater rights independently. Option 2 assumes that infrastructure would be constructed to deliver water to both Sulphur and Murray County RWD No. 1 and would be funded in partnership between Sulphur and Murray County RWD No. 1.

Option 1 – Conveyance infrastructure constructed from Lake of the Arbuckles to Sulphur only and funded solely by Sulphur; RWDs acquire and fund groundwater rights independently

Under Option 1, assuming a repayment period of 20 years and a 3.75 percent interest rate (the current project planning rate), the annual costs to Sulphur would be approximately $1.44 million for construction and $410,000 for O&M. The combined annual costs equal $1.85 million for Sulphur. Under Option 1, Murray County RWD No. 1 is assumed to make up their projected water deficit though acquisition of additional groundwater rights, as proposed under the No Action. The annual costs of both construction and O&M for Murray County RWD No. 1 are estimated to be approximately $1.25 million and would be funded solely by Murray County RWD No. 1.

This next step is to add the estimated annual costs of new service associated with the proposed conveyance infrastructure to the estimated annual cost of water that users pay for their existing service (i.e., baseline service). The cost of baseline service for Sulphur was estimated to be $1.04 million annually for 2010 and would increase to $1.56 million annually by 2060. The total cost for Murray County RWD No. 1 is $954,000 annually for 2010 and would increase to $1.43 million by 2060.

For Sulphur, the combined costs of new service from the Project with existing, baseline service in 2060 is estimated to be about $3.41 million annually[6]. For Murray County RWD No. 1, the combined costs of new service from additional groundwater rights with existing, baseline service in 2060 is estimated to be about $2.68 million annually[7].

Option 2 – Conveyance infrastructure constructed from Lake of the Arbuckles to Sulphur, as well as to RWDs; funded in partnership between Sulphur and RWDs

Under Option 2, the following assumptions were made regarding the cost-share of new service associated with the Sulphur Regional Rural Water Supply Project: (1) The infrastructure to deliver water from Lake of the Arbuckles to Sulphur would be cost-shared assuming a proportionate distribution of costs between Sulphur and Murray County RWD No. 1 based on total volume of demands in 2060[8]; (2) The infrastructure to deliver water from Sulphur to Murray County RWD No. 1 would be paid 100 percent by Murray County RWD No. 1. Under Option 2, the cost-share provided by Murray County RWD No. 1 would reduce annual costs for new service from $1.85 million to $1.00 million for Sulphur and from $1.25 million to $1.00 million for Murray County RWD No. 1. The combined annual costs of new service with existing, baseline service in 2060 would be $2.56 million for Sulphur and $2.43 million for Murray County RWD No. 1.

It is important to point out that these costs were calculated based on assumptions made for the purposes of this preliminary analysis; more accurate annual costs would be determinate based on a number of factors, including the actual costs of construction/O&M, as well as the results of potential negotiated contracts between Sulphur, Murray County RWD No. 1, Buckhorn, and Dougherty.

Affordability Conclusions

Figure 5 provides an illustration summarizing the affordability results. A comparison of annual project costs to payment capability indicates that under Option 1, where only the Sulphur portion of the project is constructed, Sulphur has sufficient payment capability to afford 100 percent of the construction/O&M of the project based on the highest annual payment capability threshold ($3.41 million cost versus $4.50 million capability, respectively). Similarly, the Murray County RWD No. 1 has sufficient payment capability to afford 100 percent of the construction/O&M associated with acquisition of groundwater rights under all but the lowest financial capability threshold ($2.68 million cost versus $1.99 million capability). However, Under Option 2, if the full project is constructed to deliver water to both Sulphur and Murray County RWD No. 1, then Sulphur, along with the Murray County RWD No. 1, would both have sufficient payment capability to afford construction/O&M regardless of the financial capability threshold used.

[6] Equals $1.85 million, the annual cost of new service from the project, plus $1.56 million, the maximum future annual cost for existing, baseline service.

[7] Equals $1.25 million, the annual cost of new service from the project, plus $1.43 million, the maximum future annual cost for existing, baseline service.

[8] Sulphur demands in 2060 are projected to be 1,441 acre-feet per year (54 percent); Demands of Murray County RWD No. 1 are projected to be 1,220 acre-feet per year in 2060 (46 percent).

Under the Rural Water Supply Act, Reclamation has the authority to pay up to 75 percent of construction costs, dependent on financial capability of the project sponsor. Furthermore, 43 CFR §404.44 requires appraisal investigations to analyze whether the project sponsor has the capability to pay 100 percent of the costs associated with O&M. The results above indicate that project sponsors could afford both 25 percent of construction costs and 100 percent of O&M costs.

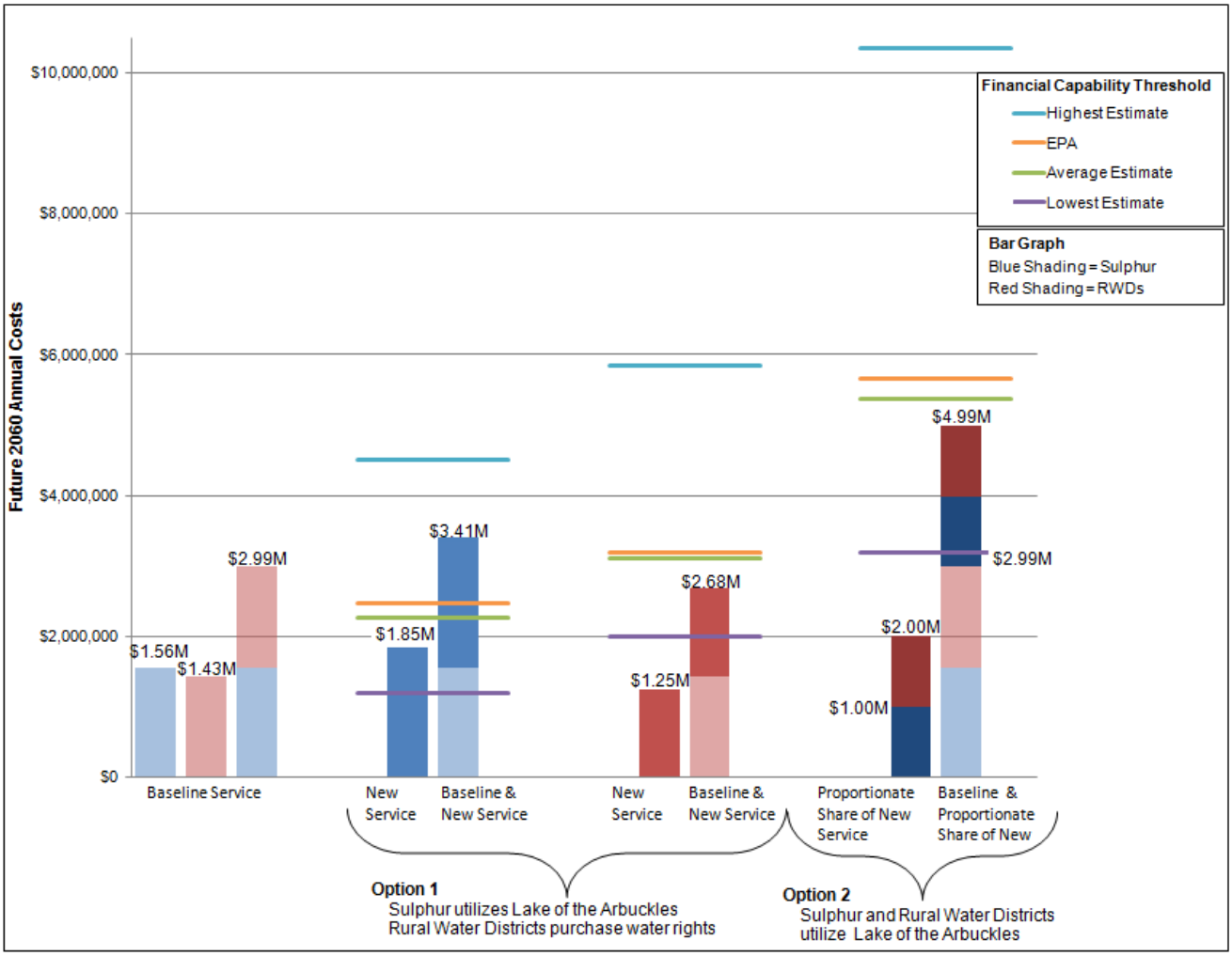


Figure 5. An illustration summarizing the affordability results by comparing the cost of baseline and new services to the financial capability thresholds. This figure assumes that Murray County RWD No. 1 would continue to sell water to Buckhorn and Dougherty; therefore, Buckhorn and Dougherty's financial capability for each threshold was included with Murray County RWD No. 1.

CONCLUSIONS

Interim Final Rule 43 CFR §404.44 establishes several criteria that Reclamation must apply to determine whether it is appropriate to recommend that a feasibility study be conducted under the Rural Water Supply Program.

Whether a reasonable range of alternatives have been formulated and evaluated.

Yes, a reasonable range of alternatives were formulated and evaluated based on their ability to meet the planning objective of reducing long-term pumping of the Arbuckle-Simpson Aquifer through development of a surface water supply alternative that conveys water to Sulphur and provides at least 707 acre-feet per year of water to Sulphur and Murray Co. RWD No. 1 by 2020, and at least 1,439 acre-feet per year of water by 2060. Chapter II of the Appraisal Investigation provides a detailed assessment of alternatives, which include the No Action (Future without the Project), as well as four supply source alternatives, including Lake of the Arbuckles, Washita River, Veterans Lake, and Water Reuse and Recycling. The Washita River and Veterans Lake were eliminated from further consideration. Water Reuse and Recycling was eliminated in this investigation due to not meeting the full 2060 deficit, but was considered viable as a supplemental water supply option. Lake of the Arbuckles was selected as the preferred source alternative that could provide the full 2060 water supply deficit.

Ten conveyance alternatives were formulated and evaluated to deliver water from Lake of the Arbuckles to Sulphur. Alternative 9 was selected as the proposed alternative. Under Alternative 9, 1,997 acre-feet per year would be released through the existing intake structure at Lake of the Arbuckles and pumped through the existing Wynnewood Aqueduct to the existing regulating reservoir, both of which are owned and operated by the Arbuckle Master Conservancy District. Water would then be pumped through a new pipeline to a new Water Treatment Plant and storage facility at the southwest corner of Sulphur's municipal water system along Chickasaw Trail and State Highway 7.

Two conveyance alternatives were formulated to deliver water from Sulphur to Murray County RWD No. 1. Alternative 1 was eliminated from consideration. Alternative 2 was selected as the proposed alternative and entails construction of a new pipeline from Sulphur water main to the Murray County RWD No. 1 standpipe.

For each alternative considered in the investigation, whether the alternative:

1. *Identifies viable water supplies and water rights sufficient to supply the proposed service area, including all practicable water sources such as lower quality waters, non-potable waters, and water reuse based water supplies.*

   The proposed alternative identified above is considered viable and would provide 1,997 acre-feet per year of treated water to meet long-term water supply needs of the service area. This water has already been allocated to Sulphur by the Arbuckle Master Conservancy District, the water right owner. All practicable water supply sources, including marginal quality (i.e., Washita River) and water reuse, were evaluated and eliminated from further consideration in this investigation. The Washita River was eliminated due to poor water quality and anticipated conveyance and treatment costs. Water reuse was eliminated from consideration in this investigation because preliminary estimates showed that water reuse alone could not bridge the full water supply deficit, even with water conservation (609 acre-feet per year

supply availability from reuse versus 847 acre-feet per year deficit with conservation). A more detailed feasibility study should explore the merits of developing the Washita River and water reuse as a means to alleviate potential impacts associated with reduced aquifer and reservoir levels. A more detailed study should examine the role that water conservation would play in offsetting water supply deficits and associated infrastructure needs in the future without-project and with-project alternatives.

2. *Has a positive effect on public health and safety.*
No adverse public health or safety effects are anticipated for the proposed alternative. Using the existing reservoir intake results in a low safety risk and would not create an additional boater safety hazard.

3. *Will meet water demand, including projected future needs.*
The delivery of 1,997 acre-feet of water per year, the full amount that can be contracted, would fully meet the 2060 demands and beyond for all water users in the study area. Detailed information on water supplies and demands are provided in Chapter I. A more detailed study should evaluate opportunities to provide water to others outside the study area, especially if Sulphur and Murray County RWD No. 1 were to implement water conservation measures and/or water reuse.

4. *Provides environmental benefits, including source water protection.*
The analysis presented in Chapter IV indicates that the Project may result in recreational and environmental benefits associated with the Chickasaw NRA due to a potential reduction in withdrawals on the Arbuckle-Simpson Aquifer. A more detailed study should consider the need to quantify recreational and environmental benefits associated with various supply alternatives, including a balance of those which result from reduced aquifer drawdown versus those associated with maintaining reservoir levels in Lake of the Arbuckles.

5. *Applies a regional or watershed perspective and promotes benefits in the region in which the project is carried out.*
The proposed alternative has the potential to provide the potable water supply needs in the study area, including Sulphur, RWDs, Dougherty, and potentially others outside the study area. The extent to which regional benefits could be provided is partly dependent on whether Sulphur and others implement water conservation measures and/or water reuse, as well as the benefit/costs associated with maintaining aquifer versus reservoir levels.

6. *Implements an integrated water resources management approach.*
The recent groundwater pumping restrictions has created a unique opportunity for Sulphur to collaborate with other stakeholders in the region on an integrated water resources management approach that meets the immediate and long-term water supply needs of the area, while at the same time reducing the economic, recreational, historic, cultural, and natural resources associated with the Arbuckle-Simpson Aquifer.

7. *Enhances water management flexibility, including providing for local control of water supplies and, where applicable, encouraging participation in water banking and markets.*
Water users in the study area are currently utilizing groundwater as their sole water supply source. Augmentation and/or replacement of groundwater with a new surface water supply source from the proposed alternative would diversify their water supply portfolio, thereby providing more local control and flexibility while ensuring a reliable water supply source well into the future. Inclusion of water conservation and/or reuse as cost-effective components in alternatives considered in a feasibility study may also provide the opportunity

for Sulphur to serve the needs of other customers outside the study area and further enhance regional benefits.

8. *Promotes long-term protection of water supplies.*
The Project promotes the long-term protection of water supplies. The water supply outlook for the area depends on different implementation scenarios with regards to prioritization of water use. As presented in Chapter IV, once permit restrictions are in place by 2018[9], if Sulphur and RWDs were to stop pumping groundwater altogether in the near term and use surface water from Lake of the Arbuckles to meet current and future demands instead, they would still have enough water to meet their needs until year 2024 (2043 with conservation). After that point, demands would exceed available surface water supplies, so additional supplies such as groundwater would be required to meet remaining demands. However, if groundwater is prioritized over surface water, then the Project would provide enough water to meet the needs of the service area to beyond 2060, although this option may come at the cost of offsetting environmental and recreation benefits. A more detailed study should evaluate how different implementation scenarios affect benefit/costs to the extent practical.

9. *Includes preliminary cost estimates that are reasonable and supported.*
Preliminary design and cost estimates were developed as one of many factors to screen conveyance options included in Chapter II. Results showed that preliminary-level costs had no bearing on selection of a conveyance option due to the low level of expected accuracy in the costs. Chapter III presents more detailed, appraisal-level designs and cost estimates of the Project. The cost estimates are reasonable and well supported as shown in Chapter III and the Appendices. A more detailed study should include geotechnical investigations, among others, to refine and develop feasibility-level project cost estimates.

10. *Is cost-effective and generates national net economic benefits.*
The present value of total project costs stated in Chapter IV is estimated to be $31.8 million. The present value of total quantified project benefits associated with avoided land costs and willingness to pay range from $20.0 million to $36.0 million. These values alone correspond to net positive economic benefits when considering the higher range of project benefits. When consideration is given to additional benefits associated with recreation and environmental resources, the Project has the potential to generate even greater net benefits. A more detailed feasibility study should refine the cost/benefits analysis by (1) Evaluating how water conservation and reuse affect projected supply deficits and avoided land costs; (2) Evaluating the net benefits associated with maintaining aquifer levels versus reservoir levels; (3) Urging project sponsors to conduct a localized survey in the study area on willingness to pay; (4) Potentially quantifying the benefits to recreational and environmental resources.

11. *Whether the project sponsor has the capability to pay 100 percent of the operations, maintenance, and replacement costs.*
A comparison of annual project costs to payment capability estimates indicates that if only the Sulphur portion of the project is constructed, Sulphur has sufficient payment capability to afford 100 percent of the construction and O&M of the project based on the highest annual payment capability estimate. However, if the full project is constructed to deliver water to both Sulphur and Murray County RWD No. 1, then Sulphur, along with Murray County

[9] The five year timeframe begins after the effective date of a final order determining the maximum annual yield.

RWD No. 1, would both have sufficient payment capability to afford 100 percent of construction and O&M regardless of the cost estimate used. Given the uncertainty in financial capability associated with the range in payment capabilities, a detailed study should more closely examine financial capability of project sponsors through an analysis on bond rating/issuer credit rating, debt service coverage ratio, and socioeconomic indicators.

12. *Other factors that Reclamation deems appropriate.*
Reclamation must consider funding availability and priorities of the Office of Management and Budget (OMB) in making any recommendation that may require Reclamation to commit financial or staff resources in future years. Funding restrictions and competing agency priorities have Reclamation with no ability to continue administering Title I of its Rural Water Supply Program.

RECOMMENDATIONS

Based on this Appraisal Investigation, Reclamation finds that the Sulphur Pipeline Regional Rural Water Supply Project is viable and appropriate for more detailed analysis in a feasibility study

Funding Sources, Options, and Prioritization Criteria

Study sponsors may seek funding for project implementation from a variety of sources both within and outside Reclamation. A detailed financing assessment is beyond the scope of this investigation, but a summary is provided below.

Funding under Reclamation's Rural Water Program – Title I (P.L. 109-451)

It is not certain whether future Federal appropriations will be made to this program, so the extent to which funding may be available for additional investigations (i.e., a feasibility study) and/or construction remains uncertain; funding for construction is contingent upon the project receiving Congressional authorization, which in and of itself is a complex outcome to achieve.

If funds are made available, Reclamation would prioritize funding in accordance with criteria set forth in 43 CFR §404.13, including:

1. *Whether there is an urgent and compelling need for a rural water supply project that would:*
    a. *Address present or future water supply needs; or*
    b. *Promote public health and safety by addressing present and preventing future violations of drinking water standards;*

    The problems and needs in the study area stem from water supply deficits that will occur from groundwater pumping restrictions on the Arbuckle-Simpson Aquifer as ruled by the state of Oklahoma, as well as the long-term environmental, recreational, and cultural impacts associated with the potential development of new groundwater supplies. If pumping restrictions on the Arbuckle-Simpson Aquifer are in place by 2018[10], a water supply deficit for Sulphur would occur in 2030 that would grow to 295 acre-feet per year by 2060. For Murray County RWD No. 1 and Buckhorn RWD, a water deficit will occur immediately[11] and grow to 1,144 acre-feet per year by 2060. Several entities in the region, including Sulphur, RWDs, and Ada, currently utilize groundwater supply from the Arbuckle-Simpson Aquifer for their drinking water. In recognition of the aquifer's historical, environmental, cultural, and recreational significance, and in response to proposals to transfer groundwater out of the basin, state legislation (Senate Bill 288) was enacted that mandated an evaluation of the impacts of groundwater pumping on the aquifer and its associated springs, streams, and lakes. The Oklahoma Water Resources Board (OWRB), in collaboration with Reclamation, U.S. Geological Survey (USGS), National Park Service (NPS), and several local entities, completed a seven-year study in 2010 on the hydrology of the Arbuckle-Simpson Aquifer (OWRB and USGS 2011). Following the study, the OWRB issued a Final Determination of Maximum Annual Yield ordering a 0.2 acre-foot per acre per year equal proportionate part of the yield to be allocated to each surface acre overlying the aquifer (OWRB 2013). This represents a *90 percent* reduction from the current temporary pumping

[10] A Final Order on the Determination of the Maximum Annual Yield of the Arbuckle Simpson-Aquifer was issued on October 23, 2013, and includes a five year timeframe for implementation.

[11] The five year timeframe begins after the effective date of a final order determining the maximum annual yield.

rates of 2.0 acre-feet per acre. The Final Determination also stipulates a *five year* timeframe for the new permitting requirements[12]. Therefore, many entities, including Sulphur, that currently depend on the aquifer, are seeking alternative surface water supply options in preparation for future pumping restrictions. These alternative supplies will not only help meet future water needs, they will potentially help mitigate long-term impacts on the numerous resources associated with the Arbuckle-Simpson Aquifer.

2. *The extent to which a rural water supply project promotes and applies a regional or watershed perspective to water resources management;*
The Arbuckle-Simpson aquifer is a sensitive sole-source aquifer that encompasses parts of six counties in south-central Oklahoma. The aquifer provides an ideal geographic setting for a regional water supply system that is connected both physically and hydrologically. At the same time, the setting provides an opportunity to manage conjunctive uses of both surface and groundwater in an area where there is a critical need to reduce groundwater pumping. The proposed alternative has the potential to provide the potable water supply needs in the study area, including Sulphur, RWDs, Dougherty, and potentially others outside the study area. The extent to which regional benefits could be provided is partly dependent on whether Sulphur and others implement water conservation measures and/or water reuse, as well as the benefit/costs associated with maintaining aquifer versus reservoir levels.

3. *The financial need of the project sponsors for assistance with the planning, design, and construction of a rural water supply project, as demonstrated by readily available local and regional economic indicators;*
A comparison of annual project costs to payment capability indicates that, if only the portion of the infrastructure is built from the lake to Sulphur, then Sulphur has sufficient payment capability to afford 100 percent of the construction/O&M of the project based on the highest annual payment capability threshold. Similarly, the Murray County RWD No. 1 has sufficient payment capability to afford 100 percent of the construction/O&M associated with acquisition of groundwater rights under all but the lowest financial capability threshold. However, if the full project is constructed to deliver water to both Sulphur and Murray County RWD No. 1, then Sulphur, along with the Murray County RWD No. 1, would both have sufficient payment capability to afford construction/O&M regardless of the financial capability threshold used. Under the Rural Water Supply Act, Reclamation has the authority to pay up to 75 percent of construction costs, dependent on financial capability of the project sponsor. Furthermore, 43 CFR §404.44 requires appraisal investigations to analyze whether the project sponsor has the capability to pay 100 percent of the costs associated with O&M. The results above indicate that project sponsors could afford both 25 percent of construction costs and 100 percent of O&M costs.

4. *The extent to which Reclamation is uniquely qualified to plan, design, and build the project;*
Reclamation's Rural Water Program is uniquely suited to provide the necessary assistance to advance this project due to the strong nexus that exists between Reclamation and the partnering sponsors, all of which share a rich history of collaborating to better manage water in south-central Oklahoma. First, Reclamation owns the Arbuckle Project/Lake of the Arbuckles and therefore bears responsibility for approval of this project. Second, Reclamation should have a strong federal interest in fulfilling the authorized purpose of the Arbuckle Project, which is to provide water to all five entities, including Sulphur.

[12] The five year timeframe begins after the effective date of a final order determining the maximum annual yield.

5. *Whether a rural water supply project helps meet applicable requirements established by law;*
   As previously mentioned, the OWRB recently completed a seven-year study on the hydrology of the Arbuckle-Simpson Aquifer. Following the study, the OWRB issued a Final Determination of Maximum Annual Yield ordering a 0.2 acre-foot per acre per year equal proportionate part of the yield to be allocated to each surface acre overlying the aquifer (OWRB 2013). This represents a *90 percent* reduction from the current temporary pumping rates of 2.0 acre-feet per acre.
6. *The extent to which a rural water supply project is ineligible for comprehensive funding (sufficient to fully fund planning and construction of the entire project) through other assistance programs;*
   Many avenues of funding exist to move this project forward. See next section below.
7. *The extent to which a rural water supply project is identified as a priority by state, tribal, and local governments;*
   The OWRB completed a Comprehensive Water Plan in 2012, Basin 14 (Lower Washita Region) which identified potential solutions to alleviating projected water supply imbalances. The proposed project would fall within the "typically effective" category for alleviating projected imbalances. The Chickasaw Nation has strong ties to the Sulphur area. The Chickasaw NRA is a favorite destination for tourists in south-central Oklahoma due to its many springs and creeks. The Chickasaw Nation recently completed its Indian Cultural Center located just west of the Chickasaw NRA. The Cultural Center sits on 109 acres and has 96,000 square feet of buildings, including a welcome center, gift shop, research center, theater and café, exhibit center, honor garden, amphitheater, and a traditional village. The Chickasaw Nation is also in the process of constructing a hotel, gaming center, and botanical gardens. Overall, the Chickasaw Nation is highly supportive of the proposed project and is committed towards providing any necessary assistance. The Chickasaw Nation realizes that Sulphur's utilization of Lake of the Arbuckle's water right allocation would decrease demands on groundwater supplies, thereby potentially improving flow from the springs and streams in the Chickasaw National Recreation Area. These water sources are critical to sustaining the local ecosystem, preserving the Nation's rich cultural heritage, and maintaining the economic viability of the area. The City of Sulphur is committed to evaluating all viable options, including the proposed project, to ensure its citizens have a reliable water supply into the future.
8. *Whether a rural water supply project incorporates an innovative approach that effectively addresses water supply problems and needs, either by applying new technology or by employing a creative administrative or cooperative solution;*
   The City of Sulphur is coordinating with area stakeholders to develop a scope of work to evaluate the benefit/costs associated with various water management options that address water supply problems and needs, and to develop a preferred implementation plan that employs innovative approaches and utilizes advanced technologies to the extent possible.

Funding under the existing Arbuckle Project authority (P.L. 87-594)

Project sponsors also have the option of seeking Federal appropriations for construction under the existing Arbuckle Project authority (P.L. 87-594). However, it is important to note that: (1) while the existing Arbuckle Project authority clearly allows for construction of a conveyance system from the reservoir to Sulphur, there is some question as to whether the existing authority is broad enough to allow for construction of a water treatment plant and/or a rural water conveyance system; and (2) any appropriations provided under the existing Arbuckle Project

authority would be subject to conditions of a repayment contract which would require Sulphur to repay 100 percent of construction costs (with interest) within 50 years of the date of water delivery.

Funding options outside Reclamation

Reclamation policy also requires appraisal investigations to make efforts to explore funding sources outside Reclamation so that resources could be leveraged to the maximum extent possible to avoid programmatic overlap. Project sponsors have already begun contacting entities that have programs that could potentially provide planning or construction assistance on this project. Each entity was successfully contacted, and additional follow-up will be conducted as needed during future planning phases of this project. A synopsis of those outreach attempts and potential funding sources are described below:

1. OWRB-administered State Revenue Bond Issue (1985) is a low-interest public water and sewer loan Revenue Bond Loan Program that offers a variable interest rate with a fixed rate conversion option.
2. OWRB-administered Clean Water State Revolving Fund (CWSRF) loan program was established by the 1987 Clean Water Act amendments to provide a renewable financing source for statewide wastewater infrastructure and polluted runoff control needs while protecting the State's surface and ground waters. The CWSRF is funded by EPA capitalization grants, State matching funds, and bonds. During fiscal year 2013, the OWRB will continue offering financing at approximately 40 percent below market rate.
3. OWRB-administered Drinking Water State Revolving Fund loan program (1997) is funded by EPA capitalization grants, State matching funds, loan repayments, investment earnings, and bonds. The low-interest loan program is administered cooperatively by OWRB and ODEQ to assist communities with public water supply infrastructure construction projects.
4. OWRB-administered Rural Economic Action Plan (REAP) Grants (1996) is a point-based program designed to assist smaller communities that lack sufficient fiscal capacity. REAP grants are match-free with a maximum grant amount of $150,000. Cities, towns, and municipalities with a population less than 7,000 can apply, but populations less than 1,750 are given priority.
5. U.S. Department of Agriculture (USDA) Water and Wastewater Disposal Systems for Rural Communities offers grants and loans for communities and tribes with a population less than 10,000. According to the 2005-2009 census, Sulphur had a population of 4,806. This may be a source of funding and will be explored further.
6. USDA Technical Assistance and Training Grants may be a source of funding if a private non-profit organization with expertise in water and wastewater issues is willing to work on the project.
7. USDA Emergency Community Water Assistance Grants are probably not a good source of funding because Sulphur has not experienced a significant, emergency decline in water quantity or quality.
8. USDA Rural Development Grants are probably not a good source of funding since they deal primarily with emerging businesses with fewer than 50 employees.

9. USDA Water and Waste Disposal Loans and Grants provide water and waste disposal to residents in counties where the per capita income does not exceed 70 percent of the national average. The per capita income of Sulphur (in 2009 inflation-adjusted dollars) was $16,886, whereas the national average was $27,041. Therefore, the per capita income for Sulphur is 62.4 percent of the national average; therefore, this grant could be a potential source of funding.
10. USDA Rural Housing Site Loans provide affordable housing for low income individuals in towns of 10,000 or less. This project does not relate with housing; therefore, this program is not considered as a viable funding source.
11. USDA Very Low House Repair Loans and Grants provide home repairs and repairs to water and wastewater disposal systems to homeowners with incomes less than $23,000. Because this project is for a municipality and not an individual property owner, this program is probably not a viable funding source.
12. Housing and Urban Development (HUD) Community Development Block Grant, Small Cities Program provides funding for housing, water and wastewater in low income areas excluding those areas in large cities. Sulphur may qualify because 22 percent of the population is below poverty level (national average is 13.5 percent).
13. HUD States Program provides funding to the states to distribute to low and moderate income communities to develop housing including water and wastewater. Sulphur may qualify since 22 percent of the population is below poverty level (national average is 13.5 percent).
14. HUD Indian Community Development Block Grant Program provides grants to develop water and wastewater in low and moderate income families. This funding is strictly for tribal projects; therefore, this program is not considered a viable funding source.
15. U.S. Environmental Protection Agency (EPA) State Revolving Loan Program provides construction funds for municipal wastewater treatment facilities. Because this project involves potable water transmission and treatment, this funding is probably not a viable source.
16. Economic Development Administration Public Works and Development has funding available for construction of public works facilities to create development opportunities in areas experiencing severe economic distress. Because Sulphur is not experiencing severe economic distress, this program is not a viable source of funding.
17. Department of Indian Health Services provides funding for water supply and sewage treatment facilities for Indian Tribes. Because the Native Indian population in Sulphur is only estimated to be about 6.4 percent, this is probably not a viable source of funding.
18. U.S. Army Corps of Engineers (USACE) assists in the design and construction of water and wastewater facilities on a reimbursable basis. The USACE could be considered for future planning phases and construction.
19. U.S. Department of Interior, Bureau of Indian Affairs, Rural Water Projects: funding to construct and maintain rural water systems on Indian Reservations. This project would not qualify for funds from this program.
20. U. S. Department of Interior, Bureau of Indian Affairs ,Water Management, Planning and Pre-Development Program: provides funding to Indian tribes for technical research and

studies associated with adjudicated and decreed water rights, or water that is otherwise appurtenant to Indian trust lands, including public domain allotments. This may occur through coordination with governmental entities by obtaining information describing the quantity and quality of water through surface and ground water assessments, inventories, monitoring, modeling and gauging. This program does not fund construction but could be considered for future planning phases.